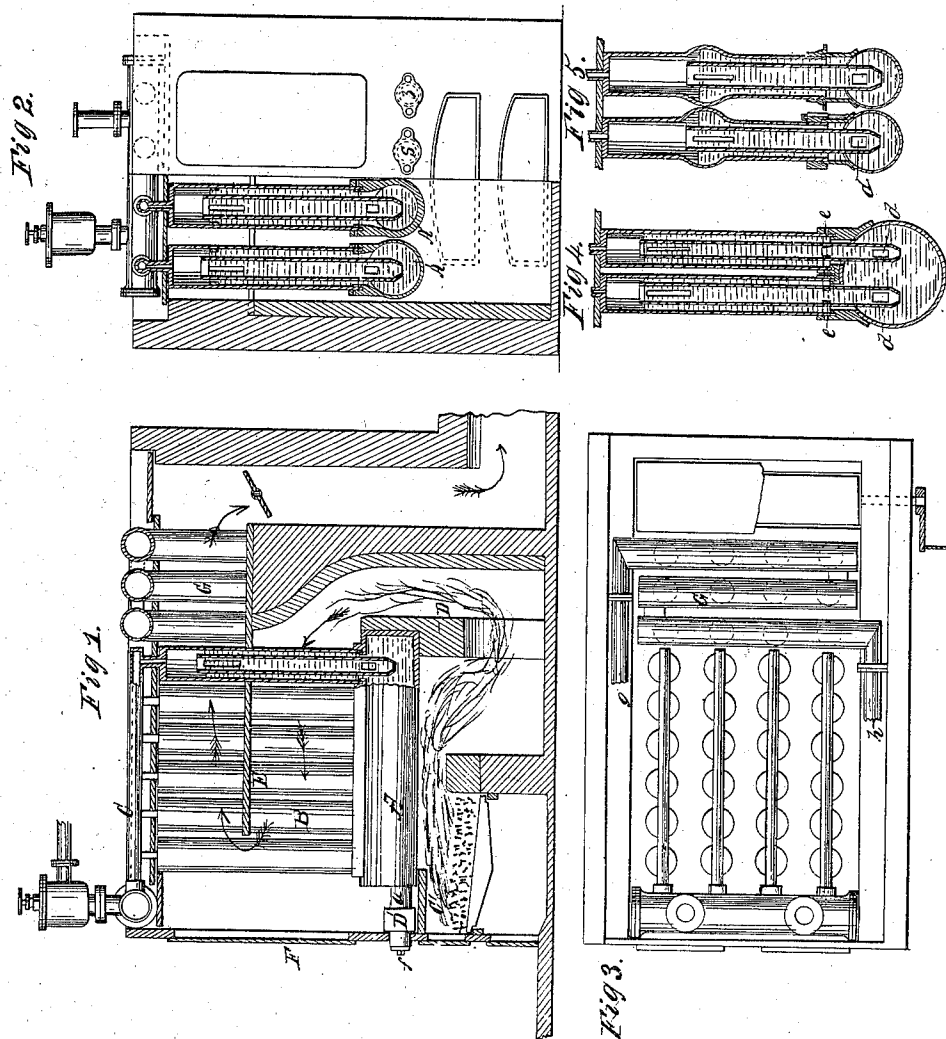


J. HOWARD & E. T. BOUSFIELD.

STEAM GENERATOR.

No. 81,638.

Patented Sept. 1, 1868.



Witnesses.
 J. A. Morgan
 G. C. Cotton

Inventor
 J. Howard
 E. T. Bousfield
 per Murray & Atkins
 M. S. Z.

United States Patent Office.

JAMES HOWARD AND EDWARD TENNEY BOUSFIELD, OF BEDFORD, ENGLAND.

Letters Patent No. 81,688, dated September 1, 1868.

IMPROVEMENT IN STEAM-GENERATORS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that we, JAMES HOWARD and EDWARD TENNEY BOUSFIELD, of Bedford, in the county of Bedford, England, have invented a new and useful Improvement in Steam-Boilers; and we do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 represents a side elevation of our improved boiler with a partial section, the side wall of the furnace being removed.

Figure 2 represents a partial front elevation and cross-section.

Figure 3 represents a top view.

Figures 4 and 5, detached sectional views of the sections.

Similar letters of reference indicate like parts.

The nature of our invention relates to improvements in steam-boilers, whereby it is intended to improve the construction and increase the efficiency of the same.

Hitherto, in manufacturing our improved boilers, we have placed the several sections of tubes transversely of the furnace, and we have connected the bottom horizontal tube of each section with a feed-water pipe common to all. These connections were made underneath the bottom horizontal tubes, the ends of which were closed.

According to our present invention, in order to afford increased facility for removing calcareous or other deposits from the bottoms of the sections, and also to adapt the boiler to confined positions, as, for example, when the front of the furnace only can be approached, we propose to place the sections longitudinally of the furnace and heating-chamber, and to gain access to the lower horizontal tubes of the sections through their front ends.

Another part of our invention has for its object to increase the efficiency of the inner circulating tubes, and incidentally to allow of the clearing out of the horizontal tubes, as above explained.

Hitherto we have formed these tubes with open ends, and cut vertically wedge-shaped or pointed slits through the ends, to provide for the circulation of the water.

By this arrangement, however, the upward and downward currents somewhat interfered with each other, and as these internal tubes rest on the bottoms of the sections, they would effectually prevent the introduction of the scraper, as above described.

To remedy these defects, we propose to suspend the inner tubes clear of the bottom of the sections by fitting them with wing-pieces which will rest upon the shoulders of the couplings of the longitudinal tubes. We also close, or nearly so, the bottom of the pendent inner tubes, bringing them to the form of an inverted cone, and just above the cone we make lateral openings in the tubes, so that the descending water may flow through the same.

In order to utilize, as far as may be, the heat of the gases of combustion, before they escape into the chimney, we set in the flue leading to the chimney a group of short sections, through which we cause the feed-water to circulate on its passage to the larger sections or boiler proper. These short sections are fitted with internal circulating-pipes.

On reference to the accompanying drawings, A represents the lower horizontal tubes, B the vertical tubes, and C the upper horizontal tubes of the several groups, which are arranged, with reference to the furnace, so as to present the ends of the horizontal tubes towards the front; the front ends of the tubes A being supported on a plate or bracket, C', projecting inward from the front wall, and the rear ends may be suspended from a bar secured to the upper side of the bottom tubes, or from a bar passing through the same, or, as shown in the drawings, by a perforated wall, D, of fire-brick, which will allow of the current of heated gases passing out of the fire-chamber, with a view of being returned to act upon the upper part of the boiler.

Across the front ends of the lower longitudinal tubes of all the sections, a feed-water pipe, D, passes, having openings on one side corresponding with the openings in the ends of the lower horizontal tubes of the

sections, and recesses for receiving the ends of short tubes *a*, connecting the ends of the said horizontal tubes with the tube *D'*. On the opposite side the feed-water pipe, and coinciding with these openings, are other like openings, which are closed by the lids or bonnets *f*. This arrangement admits, by simply removing the bonnets, of the introduction of a scraper, to remove any deposit that may form on the bottom of the tubes *A*.

In cases where it is desirable to increase the water-space in the lower horizontal tubes, we propose to make them of sufficient diameter to receive two or more rows of the vertical tubes, instead of one row, as is shown in fig. 4, and in order to increase the surface of the water at the water-line, and thus to diminish the variation of the height of the water-level, we propose to swell out the vertical tubes at that point in a spherical form, as shown in fig. 5. In a line with the horizontal axis of these spheres, we divide the furnace into upper and lower chambers by a dividing-plate, *E*, and the flame and heated gases, after passing out of the lower chambers into the space between the front plate *F* and the tubes, we turn into the upper part of the sections of the boiler.

Instead of resting the lower ends of the inner circulating-tubes on the bottom of the lower horizontal tubes, as heretofore, we propose to suspend them clear of the bottoms of the said tubes by fitting them with wing-pieces *e*, as shown in fig. 4, which will rest upon the shoulders of the couplings of the vertical tubes with the horizontal tubes. We also close, or nearly so, the bottom ends of the pendent inner tubes, bringing them to the form of an inverted cone, and just above the cone we make lateral openings *d* in the tubes, so that the descending water may flow through the same. The form of the inverted cone which we adopt offers the least resistance to the upward flow of the heated water.

In order to facilitate the fixing of the flue-division plate and the top-covering plates in cases where the top of the boiler is not accessible, we propose to connect the top and division-plates together, and fit them to the sections before putting the sections in place.

By this arrangement, when the sections are set side by side in the furnace, the flues will be complete.

G represents a series of short sections of vertical and longitudinal tubes, also provided with internal circulating-tubes, which are set in the flue leading to the chimney, through which we cause the feed-water to circulate on its passage to the larger sections of the boiler proper, in order to utilize, as far as may be, the heat of the gases of combustion before they escape.

g represents a feeding-tube, and *h* a tube connecting the heating-sections with the feed-water tube *D'* connecting with the sections *A* in front.

Having thus described our invention, we claim as new, and desire to secure by Letters Patent—

1. The construction and arrangement of the vertical tubes *B* and their inner tubes with the horizontal tubes or pipes *C* and *A*, whereby access is gained to the pipes *A* through the feed-pipe, as above explained, for cleaning the boiler.

2. The construction of the horizontal pipes *A*, arranged with the feed-pipe, having covered openings, whereby to gain access to the interior of the boiler, for cleaning out the same.

3. The internal tubes, constructed with lateral openings at bottom, as described, whereby to keep up the circulation of the water in the boiler, and the arrangement of the tubes, as described.

4. The heating-sections *G* for heating the feed-water, arranged in combination with the larger boiler-sections, substantially as and for the purpose described.

The above specification of our invention signed by us, this 10th day of April, 1868.

JAMES HOWARD,
EDWARD TENNEY BOUSFIELD.

Witnesses:

JOSHUA NUNN, *Deputy Consul*, } *Consulate U. S. A., London.*
D. S. BARKER, *Clerk*,